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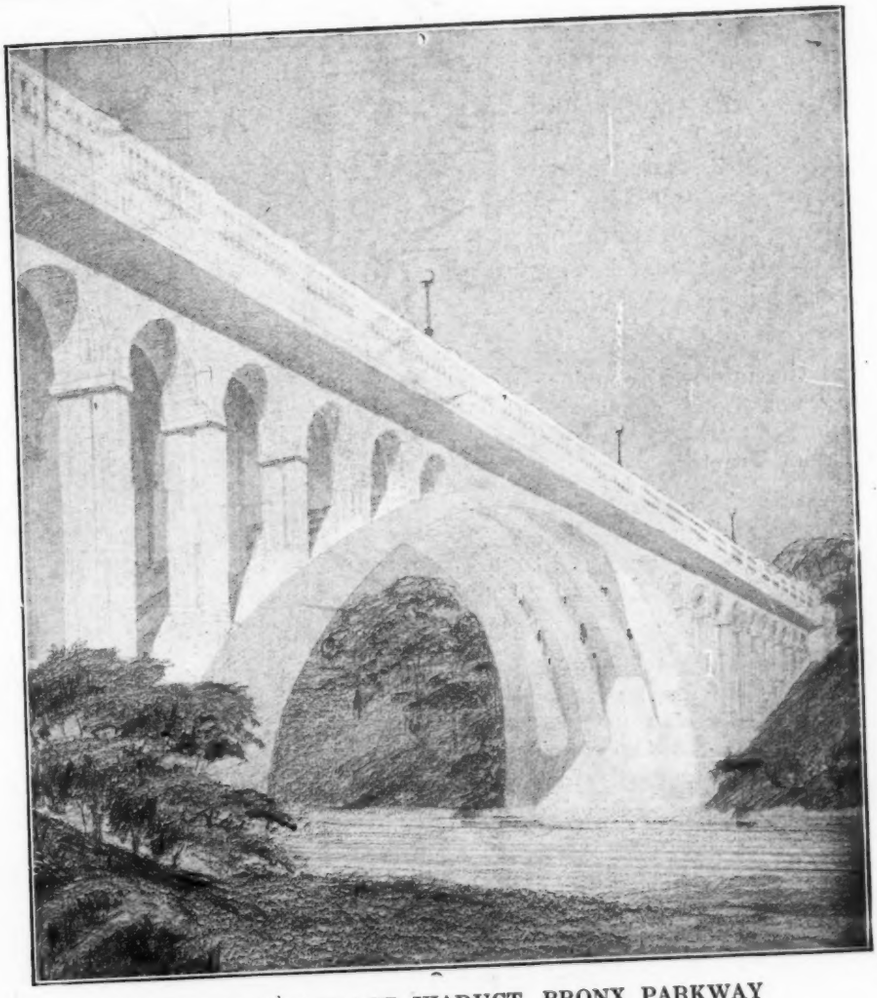

WOODLAND PLACE VIADUCT, BRONX PARKWAY

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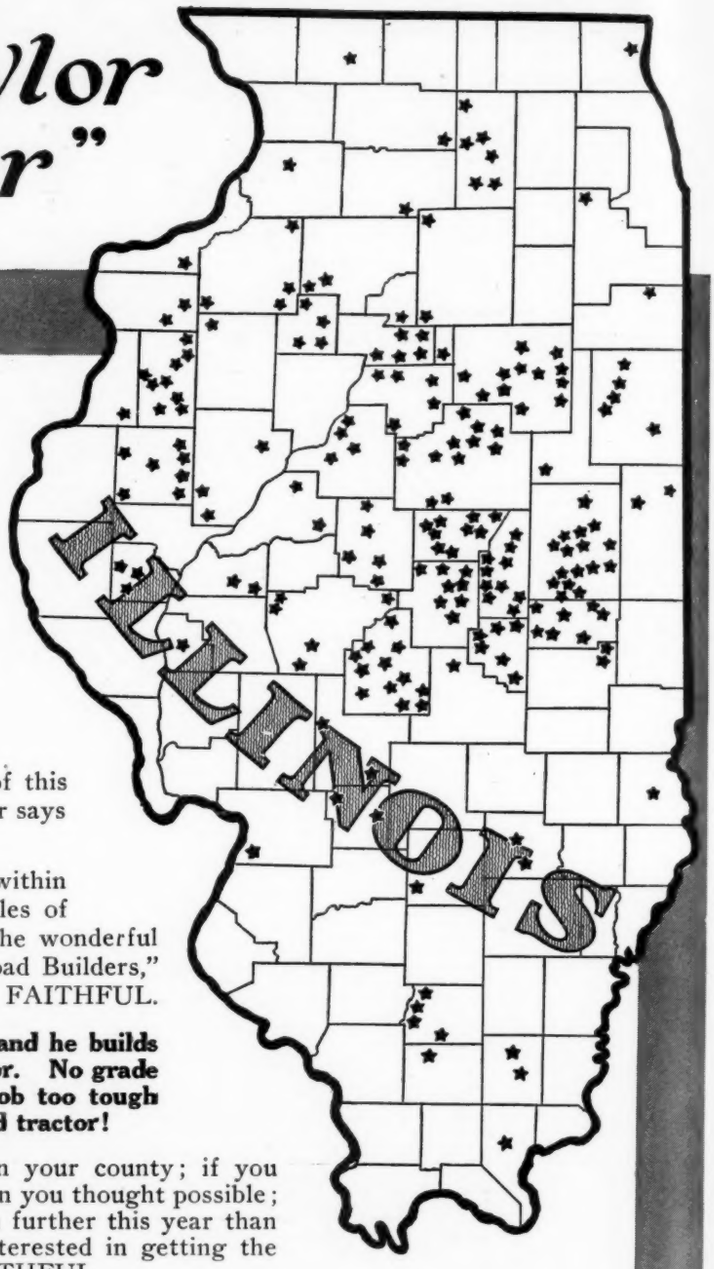
MARCH 18, 1922

and Every Star Says-

"Aultman-Taylor Road Tractor"



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PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 52 March 18, 1922 No. 11

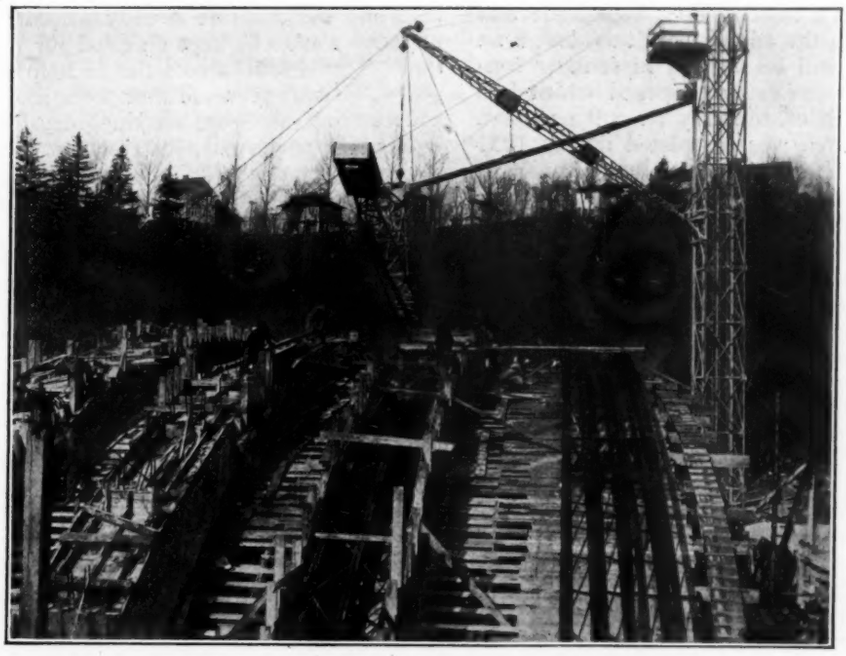
Woodland Place Viaduct

By James Owen*

Ornamental concrete bridge constructed jointly by Bronx Park Commission, City of White Plains, State of New York, and N. Y. C. Railroad. Some features of the plan, specifications, and construction methods.

The public desire now frequently manifested for higher architectural standards in bridge design is exemplified by such structures as the Woodland Place Viaduct now under construction over the Bronx river and Harlem Division tracks of the New York Central Railroad at White Plains, N. Y. In this locality the railroad follows the Bronx river valley which lies betwen roughly parallel north and south ridges. The Public Service Commission several years ago issued an order for the elimination of Tibbets avenue grade crossing over the Harlem Division tracks at this point, and a column and girder viaduct structure was originally proposed for spanning the river and railroad tracks, as shown in one of the accompanying illustrations.

When this plan was under consideration, the Bronx River Parkway Reservation, consisting of a strip of land on both sides of the Bronx river, was being established. As the parkway project includes a motor driveway, and topographical conditions make it necessary for this drive to cross the railroad tracks and valley in the same locality, negotiations were carried out to make the viaduct a joint undertaking of the Bronx Parkway Commission, city of White Plains, New York Central Railroad and State of New York. This co-operative project will result in an overgrade crossing combining Tibbets avenue and

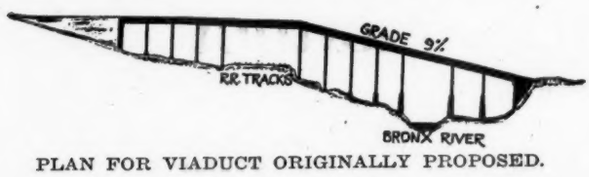


VIEW FROM EAST END, SHOWING REINFORCEMENT, FORMS, AND CONCRETE TOWER AND CHUTES.

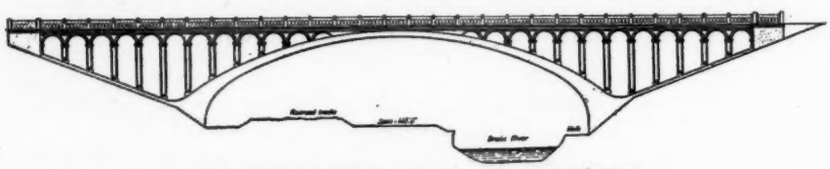
*Senior Assistant Engineer, Bronx Park Commission.

the Parkway drive without duplication of expensive structures.

A secondary but important consideration was to get architectural treatment of the viaduct, acceptable to the Bronx Parkway Commission and in harmony with Parkway development in the vicinity. An accompanying illustration shows the adopted design, consisting of an arched span of 145 feet, with a rise of 33 feet. The arch consists of four reinforced concrete ribs tied together with struts to secure the required lateral stability, the reinforcement consisting of latticed, structural steel truss ribs.



PLAN FOR VIADUCT ORIGINALLY PROPOSED.



SECTION OF VIADUCT AS CONSTRUCTED.

The roadway on a gently cambered gradient is supported by spandrel columns which, on the two outer ribs, are spaced by full centered spandrel arches and there is an agreeable treatment of balustrade and lighting details. By the adoption of this design an imposing structure will be secured in striking contrast with the plan originally proposed which had a considerable length of roadway on a 9 per cent. grade. The four arch ribs completed during 1921 by John F. Cogan Co., contractors, now furnish an idea of the appearance of the completed structure as seen through the long valley vistas north and south of its location.

The construction of the viaduct did not develop any problems of note. Satisfactory foundations on hard-pan were found at easy depths below the ground surface. The Bronx Valley sewer 54 inches in diameter passes under the westerly abutment. Piles were therefore driven to carry this abutment, supporting it entirely clear and independent of the sewer structure, with 30-inch footing walls carried down to invert elevation on either side of the sewer barrel, but not in contact with it.

Substantially timbered arch falsework was used and provided a clearance span for the double track railroad line passing through it. Concrete was placed from a steel tower having a boom adjustable to any required elevation for supporting chutes that command the entire arch span, abutments and spandrel columns.

As previously stated, the viaduct when completed will not only serve to eliminate the old grade crossing formerly open at this point but will also provide a valley crossing for Bronx River Parkway Drive. The drive is now paved and open to traffic from Scarsdale to the viaduct, from which it will continue northward to Main street in White Plains and ultimately to Kensico Dam at Valhalla.

The viaduct design and construction have been under the general supervision of Jay Downer, chief engineer of the Bronx Parkway Commission, with Guy Vroman as consulting engineer and in direct charge of the work. The architectural design was furnished by Palmer and Hornbostel of New York. Unless there are unforeseen occurrences, the viaduct should be open to traffic before the end of 1922.

SPECIFICATIONS

As supplementing the above article by Mr. Owen, some of the features of the specifications for this viaduct will be of interest.

The proportions of the concrete were left to be determined by the engineer, but the fine and coarse aggregates were to be measured separately by volume in approved receptacles. The amount of vegetable matter in the fine aggregate was not to exceed 3%, while the coarse aggregate was to contain no loam or clay, but was to be washed if necessary to remove such material, and should all pass through a 2-inch mesh screen.

In order to insure that arches and other portions of the concrete for which it might be necessary could be completed in one operation, complete duplicate mixing and conveying machinery for performing such work was required, and an interruption of more than 15 minutes' duration to continuous placing might be a cause for rejecting the concrete already placed. In addition, material was to be kept on hand for the rapid erection of bulkheads across the arch in case of emergency. It was required that precautions be taken to prevent concrete from becoming dry for at least two weeks, for which purpose frequent spraying, covering with wet cloths or other acceptable means were to be employed, and green concrete was to be protected from hot sun and dry winds.

Where expansion or slip joints might be required, they were to be built with smooth faces coated with cold-water paint or other approved substance or covered by paper or similar compressible material. Where water-tight work was required, the joints were to be grooved and filled with an acceptable, durable, water-proof and elastic cement.

The surfaces of sidewalks were to be given a granolithic finish. A part of the exposed concrete surface was to be pointed or tooth-chiseled or dressed by machine tools producing equivalent effects. The tool dressing was to be carried not nearer than 1-inch to any edge and the edges were then to be rubbed with carborundum stone and washed with water.

The contractor was to bid a lump sum for the falsework, 50% of the bid to be paid to him when it had been erected and the remaining 50% when it had been satisfactorily removed.

The backs of the abutments and portions of the end retaining walls were to be water-proofed, felt being used for this purpose saturated with pitch and weighing not less than 15 pounds per hundred square feet; the pitch used being that known as "straight run coal-tar pitch." The water-proofing was to consist of three layers of felt and four layers of coal-tar pitch, alternating. great care being taken that all the joints in the felt were broken with laps

at least 6 inches wide. The felt was to be rolled out into the pitch while the latter was still hot so as to insure complete adhesion throughout.

A conduit system for lighting cables was built in the viaduct, vitrified clay ducts being used.

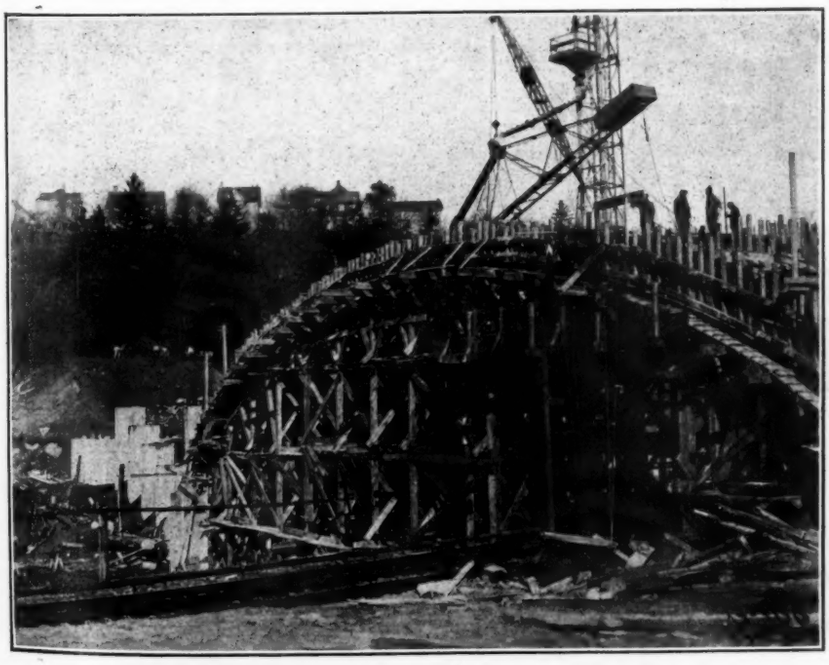
The roadway was paved with asphalt blocks, specified to be 5 inches wide, 12 inches long and 2 inches deep, with a variation of not more than ⅛ inch in width or depth or ¼ inch in length.

CONSTRUCTION NOTES.

Aggregate was delivered by a derrick and clam-shell bucket to the hopper bottom storage bin over the Ransome 14-S concrete mixer, which discharged into a hoisting bucket in a Ransome steel tower, 135 feet high with movable boom and receiving hopper, that provided for the delivery of the concrete to the counterbalanced chute, from which it was spouted to position in the forms. The derrick handling the aggregate was installed on the opposite bank of the river from the mixer, which was operated by a steam engine. The location of the hoisting tower near the center of the bridge enabled all parts of the structure to be reached conveniently by the spouting system illustrated by the engravings.

This system was a modification of the one originally proposed, which dispensed with the chute derrick and counterweighted truss, using instead a set of three standard No. 120, one No. 114 and two No. 115 sections of Ransome chutes, suspended from a 1-inch plow steel cable reaching from the top of the hoisting tower to a small auxiliary tower beyond one end of the bridge, and then to an anchorage, and thus providing for the concreting of a little more than one-half the bridge, after which it was proposed to shift the cable and suspended chute to the opposite end of the bridge, thus completing the concreting with a minmum of plant.

The method finally adopted avoided any relocation of plant, and provided for rapidity and convenience in handling the concrete, which, by this method, could be deposited on both ends of the bridge alternately, maintaing a symmetrical loading of the falsework and producing balanced stresses there that would not have been obtained by concreting the span in successive halves.



WOODLAND PLACE VIADUCT, SOUTH SIDE.
Showing falsework over railroad, westerly spandrel columns, and approach fill being placed.

Purifying Tomato-Canning Wastes

Experiments recently completed by the U. S. Public Health Service on the purification of tomato-canning wastes indicate that these wastes and also those from factories packing other vegetables and fruits can be so purified that they may be discharged without nuisance into relatively small bodies of water.

The experiements were begun by the Service at Farnham, N. Y., at the request of a "full-line" canning company, after the company had found itself unable to obtain information from any other source as to methods of purifying its wastes. This factory, however, was burned while the testing plant was under construction, and the tests were carried out at a tomato-canning plant at Amelia, Ohio.

The wastes treated consisted of the liquids from washing down floors and cleaning utensils and apparatus and those from scalding the tomatoes, but did not include tomato cores, skins, or pulp. The solids, including the pulp, which had to be wasted, were hauled away and ploughed into the ground. The volume of wastes treated averaged about one-half gallon per No. 3 can of tomatoes packed (1,000 cans to the ton).

The liquid wastes were pumped to settling tanks, in which about 85 per cent of the solid matter held in suspension was removed and the citric acid of the tomatoes was largely converted into lactic acid.

The solids separated in the settling tanks were disposed of on beds composed of a few inches of sand resting on a shallow bed of cinders. An area of 2.4 square feet will take care of wastes of this nature resulting from each 2,000 No. 3 cans of tomatoes packed.

The effluent from the settling tanks was run through a bed of coarse cinders 4.5 feet deep and later through a bed of sand of the same depth. The rate of filtration through each filter was 75,000 gallons per day.

The effluent from the sand filters was clear and non-putrescible. Fish lived for six weeks in small concrete basins that were supplied only by the filtered waste. Neither odors nor other objectionable features that would militate against the use of tanks and filters near the canning factory were observed.

Milwaukee City Planning

City limits extended and entire area districted according to use, height of buildings, and area of lot occupied by buildings; streets widened, grade crossings eliminated, belt park planned, property acquired for the improvements and civic center located for group of imposing buildings.

In 1916 efforts that had been in progress without much result for seven years secured an appropriation from the Common Council of the city of Milwaukee enabling it to engage engineers and assistants to investigate and design various important plans for the improvement and beautification of the city.

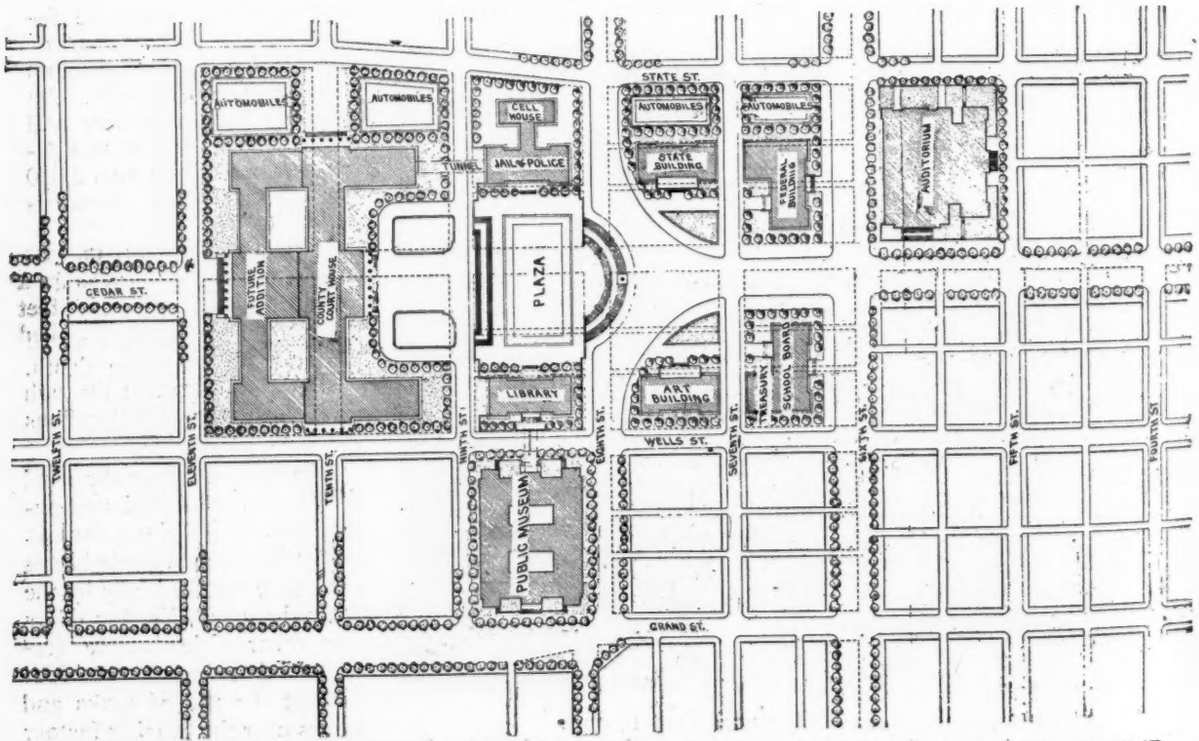
The policy was adopted of concentration of efforts on the execution of a few very desirable improvements and has already resulted in the widening of 15 miles of Oklahoma avenue and Lake street in the outskirts of the city. Most of the grade crossings have been eliminated and the remainder, that have already been ordered by the state railroad commission, will be removed by the expenditure of nearly $4,000,000.

The population of about 500,000 people in an area of 26 square miles is denser than that of any other city in this country and necessitates extension of the city limits which will soon be effected by the addition of several square miles of territory, which has been vigorously petitioned.

A complete survey has been made of the city and of the adjacent territory for three miles beyond the city limits, showing all wooded areas and other lands suitable for parks and playgrounds, which have been mapped to show a parkway surrounding the city and affording a continuous 30-mile drive through the parks and following in large measure valleys of small streams and presenting a beautiful variety of scenery, which will be preserved and enhanced by the municipal ownership and has already been acquired for a proportion of the territory.

The harbor commission is planning the greatest harbor on the Great Lakes, the construction of which is already under way. The acquisition of more land for it has progressed and $1,250,000 worth of additional land has been acquired for it already.

In November, 1920, the Common Council adopted a zoning ordinance prepared by the Land Commission establishing three kinds of districts, according to the use, height and area, to control the character of future construction and occupation. The use district map divides the city into residence, local business, commercial and light manufacturing and industrial districts. Regulations as to height limit the heights of the buildings to 40, 60, 85 and 125 feet respectively in the different districts. The area district map divides the city into four classes of districts in which the area of a lot which may be built upon, is unlimited in the first district, is from 75 to 85 per cent in the second district, from 50 to 60 per cent in the third district and from 30 to 40 per cent in the



PLAN FOR STREET IMPROVEMENTS, PLAZA AND PUBLIC BUILDINGS FOR MILWAUKEE CIVIC CENTER

fourth district. The ordinance also limits the number of families that may be housed on any lot, and prescribes minimum dimensions of courts and yards to insure sufficient sunlight and fresh air.

The industrial development of the city has also been planned so that in certain districts only temporary homes will be permitted, thus providing for future industrial expansion there. Only necessary improvements will be executed there now, and the area will be left free from the limitations of ordinary city blocks.

A topographic map is to be made of a 36-square-mile area 1½ miles wide surrounding the city, which the county board will zone in accordance with city plans, so as to insure proper development and conformity to the general plan for water and sewer development.

An important feature of the preparatory work of the Land Commission has been the preparation of about 60 large-scale standard maps and plans, including zoning studies and approved districts, maps showing values, growth and building areas in different years and residence development; height and area and use districts; density of population; park and wooded areas; sewer and water systems; arterial highways, main highways, parks and boulevards; residence, business and factory districts; intensive development of business sections; time zone charts; railroad facilities and grade crossing elimination; street grades; location of objectional industries, and various other essential features.

One of the most attractive improvements is the establishment of a great civic center occupying directly and indirectly about 12 city blocks, symmetrically arranged on both sides of Cedar street from Sixth to Eleventh street, involving the acquisition of real estate assessed at $3,500,000 which is now being purchased or to be secured by condemnation to provide for sufficient space for the important buildings and streets and to give the city control of adjacent property, enabling it to resell frontage on the new artery with such property restrictions as will insure the proper development there.

Cedar street is being widened to 180 feet from property line to property line, thus leaving a 100-foot roadway flanked with wide sidewalks and double rows of trees, and forming a main artery leading to a central plaza which will provide a great open air auditorium concentric with the principal municipal buildings, which will be successively constructed with harmonious dimensions and uniform architectural effects. The plaza and adjacent streets will be abundantly provided with shade trees, parking, shrubbery, and flower beds and the lofty and symmetrical buildings will have beauty, individuality and a rich, dignified finish suitable to their public character and imposing arrangement.

This plan co-ordinates with the construction there of the new court house for Milwaukee county and several new municipal administrative buildings that have been authorized and will, when completed, effect considerable economic advantage and expedite and simplify public business.

The buildings immediately adjacent to the plaza will be the library and county jail, on opposite sides, adjacent to wings of the county court house, entirely occupying a third side, while the state building, federal building, art building and educational building form a quadruple group on the court side. Beyond these buildings on one side is a large public auditorium.

Between 8th and 9th streets, opposite the library building, is a public museum which occupies about two-thirds of the block and containing some of the finest and largest of municipal collections, especially including ethnological exhibits of high historical and cultural value and exceptionally important industrial and zoological collections. This museum is at present about fifth in point of size of the museums of natural history and anthropology in the United States. It ranks among the first in its environmental groups and it is embarking upon a very greatly extended program of group building.

It is hoped that activities on the structural operation of the civic center will soon be commenced and prosecuted uninterruptedly, although it is so planned that some of the larger buildings may be built in successive sections, thus affording occupancy long before their ultimate completion.

Large appropriations have been made and probably more will soon be authorized for the principal features of these improvements and $47,000 has been appropriated for the expenses of the Land Commission during the current year.

The surveys, engineering and structural features have been planned under the direction of Roland E. Stoetling, city planning engineer.

The Duties of a City Engineer

The duties which are required of a city engineer vary from merely giving lines and grades in some instances to taking charge of practically all of the physical property and construction operations of the city in others. In a great many cases the various functions of the city engineer are merely added to from time to time by ordinances and in many cases are not even as definitely stated as this.

The city of Sacramento has been operating under the manager form of government since July 1921 and under this form of government the city engineer has charge of the following: planning, opening, constructing, paving, maintaining and repairing all streets, boulevards, alleys, etc.; supervision over the sewers and sewerage system, the crematory and corporation yard, cleaning and sprinkling of streets; charge of the levee system of the city, the city water works and water distributing systems and filtration plant; charge of the construction, maintenance, repair and operation of all public buildings belonging to or used by the city, all wharves, docks, chutes, ships, quays and water front property; the construction and maintenance of fire and police alarm systems and of all buildings and supervision of automobile mechanics in the employ of the city and the enforcement of all rules and regulations pertaining thereto; inspection of all electric wires for furnishing heat, light or power and of the wiring of all buildings hereafter erected in the city and inspection of buildings and issueing of permits for building operation in accordance with the rules and regulations prescribed by ordinance; to which was added on October first the charge of the refuse collection and disposal.

Garbage collection and disposal was not performed directly by the city until October first. Since that time the city has been reorganizing the method of collection and expects to perform this by means of Fordson tractors and trailers in the residence district and by trucks in the mercantile district. The city has been paying about $13,500 a year for operating an incinerating plant and is contemplating closing down the incinerator and disposing of all refuse by burying it in waste land.

Quarry and Steam Shovel Work for Highway Construction

Appliances used by Virginia contractor on nine miles of road work.

The construction of 9¼ miles of a 16-foot highway by the Pace Construction Co. of Roanoke, Va., as contractors involved the excavation of 20,000 yards of earth and the hauling of 60,000 yards of earth a maximum distance of 1,000 feet. A cut was excavated by a Bucyrus 14-B caterpillar shovel, operating in shale rock and delivering from 400 to 500

DITCH DRILLING MACHINE OPERATED BY AIR FROM PORTABLE COMPRESSOR.

loads per day to Western 1½-yard dump wagons, making an average output of 500 yards per day.

The broken stone required for construction was obtained from two quarries at convenient places alongside the road. At quarry No. 1 a daily output of 150 cubic yards was secured by the use of a Sullivan D. P.-53 rotator, making holes up to 16 feet in depth. The drill was operated by air compressed by a Sullivan WK-31 portable gasoline compressor with a capacity of 150 cubic feet of air per minute. A similar compressor was used in the other quarry and to operate the steam shovel, and

QUARRY WITH 150-YARD DAILY OUTPUT.

APPLYING 600 GALLONS OF ASPHALT PER LOAD BY THE FINLAY METHOD.

they were reported by the contractor to be very satisfactory, economical and thoroughly dependable. The stone in quarry No. 1 was crushed by a Western Wheeled Scraper Co.'s crusher No. 2 that had a daily output of 150 cubic yards, and was stored in an Austin 100-ton No. 4 bin.

The best drilling record was 250 linear feet of 1¼-inch holes 16 feet deep in 10 hours. The broken stone was stored in bins that delivered to 2-yard Austin dump wagons hauled by 3-horse teams, which distributed the stone along the road.

The road surface was asphalted by the Finley method, which permits one-half of the roadbed to

BUCYRUS STEAM SHOVEL LOADING WESTERN DUMP WAGONS.

be poured through an offset attachment operated on each side of the 600-gallon tank. The asphalting was executed on a subcontract awarded to Samuel E. Finley, of Atlanta. An average force of 250 men was employed; laborers received $.25 per hour and mechanics received $.30.

Record Snow Removal from North Carolina Highways

A recent snow storm covered the entire State of North Carolina with snow to a depth of 10 to 24 inches. While the snow was still falling Frank Kay, State Highway Commissioner, sent to all of his district maintenance engineers, the following telegram:

"This snow gives you an opportunity to prove the efficiency of your maintenance organization. The condition of your roads two weeks from now will prove how good you are. Let's go."

Although the maintenance organization has been entirely built up during the last few months, each of the 300 maintenance gangs throughout the state, which are equipped with trucks, tractors, road machines, and drags, went into action without any hitch and in practically one day's time succeeded in dragging the snow on the whole of the 6,000 miles of the state highway system, cleaning the roads, and maintaining traffic on them and thus eliminating a

vast amount of delay and expense that otherwise would have been suffered by the transportation interests and the general public.

The direct saving to traffic, large as it is, is almost insignificant in comparison with the great amount of damage that would have been done to the roads themselves had the snow been permitted to remain on them until it melted, which would have injured a large mileage and practically destroyed earth roads by the churning of soft mud under traffic.

In the mountainous districts in the western part of the state, where snowfall is expected at any time, the maintenance gangs have received orders to patrol the roads with the beginning of every fall of snow and to remain at work until the roads are clear. The result is much more important there, than in the eastern part of the state, where the soil contains a much larger proportion of sand.

Fifteen Miles of Highway Concreted from a Central Mixing Plant

Sand and gravel brought from pit to screen at mixer by cableway. Maximum speed 700 linear feet a day.

Sections 8, 9 and 10 of Route 5 in Kane County, Illinois, have a 7-inch concrete pavement 18 feet wide and 15 miles long, the contract for which was awarded to the McCall Construction Co., Chicago, for $450,000.

The road is a reconstruction of 9 miles of old gravel surface and 6 miles of earth surface, having a crooked, hilly alignment with maximum grade of 4.85 per cent. and involving excavation of 63,569 yards of earth, which was accomplished by one scarifier and two J. T. Adams grading machines, with 8-foot and 12-foot blades, respectively, and hauled by a Pioneer tractor with wide face wheels which was operated by gasoline and handled about 40 yards of earth per hour.

A central mixing plant was established near the middle point of the section and in it there was installed, in the bottom of the wooden bin tower, a 1-yard Ransome Concrete Machinery Co.'s mixer, supplied with aggregate by gravity from the storage bin in the tower above it.

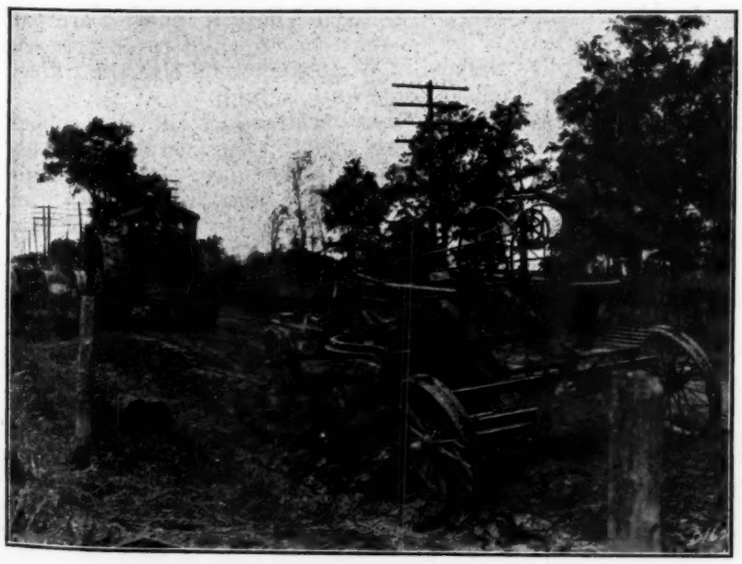
CONCRETE TOWER WITH ELEVATING MECHANISM AND CHARGING HOPPER

The sand and gravel were excavated from an adjacent pit by a Sauerman cableway excavator installed by the contractor. The trussed mast of the cableway plant was adjacent to the concrete tower and the excavation bucket dumped on a Grizzly over a revolving cylindrical screen, by which the sand and gravel were separated, and falling into a pit, were elevated by bucket conveyors to the storage bins supplying the concrete mixer.

Cement received at a railroad siding 1¼ miles away, was hauled by trucks to the central plant and stored in the 4-car shed adjacent to the mixer.

The concrete mixer was operated by two men and was set a few feet above the surface of the ground so as to deliver directly by gravity to eight Titan motor trucks.

The total amount of about 63,569 yards of pavement concrete was laid at the maximum speed of 700 linear feet per 10-hour day, at a contract price of about $5.68 per yard. There is also about 792 yards of concrete in the culverts, which, like the pavement concrete, was delivered in trucks from the central mixing plant. Water for construction purposes was derived from a driven well 175 feet deep, equipped with an air lift and a centrifugal pump, delivering 350 gallons per minute at the central mixing plant. The concrete was cured by cov-



TRACTOR HAULING GRADING MACHINE AND HANDLING 40 YARDS OF EARTH PER HOUR.

ering with 2 inches of wet earth and the application of a solution of 4 pounds of calcium chloride per square yard of surface.

The work was commenced July 1, 1921, and is now about 40 per cent. completed. It has been carried on with a maximum force of 90 men and an average force of 75 men and, it is expected, will be completed September 1, 1922.

A $60,000 Submerged Pipe Fracture

The Catskill aqueduct of New York delivers water to the Silver Lake reservoir in the Borough of Richmond at a present normal rate of about 14-million gallons daily, through about 10,000 linear feet of flexible jointed 36-inch submerged castiron pipe in 12-foot lengths laid across the Narrows in a dredged trench more than 60 feet in maximum depth, at a cost of about $1,000,000.

Although protected near the Staten Island shore by an earth cover of 20 feet at a point where the water was 30 feet deep above it, the pipe was recently broken, presumably by the spud of a dipper dredge then operating in that vicinity under the direction of the Dock Department. The fracture was indicated by the boiling of the water over the break and by the immediate increase of pumpage to 20,000,000 gallons per day.

Orders were promptly issued for the repair of the injury and within three days the pipe was uncovered by dredging, which disclosed a large hole in one length, which was forthwith cut out in about nine days with two special electric torches, each having a carbon electrode bored for the passage of the cutting gas. Each torch was operated by three divers working in successive 2-hour shifts and cutting a total amount of about 230 linear inches of cast iron, 1⅝ inches thick, 30 inches of heavier metal up to 3½ inches thick and 8 inches of 1½-inch wrought iron. Under the circumstances a progress of 2 inches per hour in cast iron 1⅝ inches thick was considered satisfactory.

Although a special split cast iron sleeve covering two joints and the intermediate section of the pipe had been designed in 1917 for the purpose of effecting repair work, none was kept in stock by the city of New York and as it was estimated to take three weeks to secure one, it was decided to insert a new length of pipe with a cast steel end connection sleeve. The enlarged portion of the spigot end of a standard length of pipe was turned down and the pipe lowered to position with bell enclosing the spigot of the adjacent old pipe and the spigot end was connected to the other end of the old pipe by a jointless steel sleeve 5 feet long previously placed over the old pipe and subsequently moved into position to cover the joint. The sleeve was provided with 12 1-inch bolts 5 inches back from each end that afforded bearings for 2x½-inch collars against which lead wool was calked in the ¾-inch annular clearance between pipe and ring. The calking is held in position by a cast steel gland or collar secured by 9 1-inch bolts to prevent the possibility of a blowout.

Repairs were made at an estimated cost of about $60,000, by the Merritt & Chapman Derrick & Wrecking Co., which originally laid the pipe.

Garbage Collection in St. Paul*

By James W. Routh

Routes, equipment and cost of collection. Arranging routes so as to obtain eight hours' work each day. Adjusting wagon capacity to local conditions.

From the foregoing it will be understood that the city collectors have been employed from time to time to take over routes abandoned by or no longer acceptable to farmer collectors. In fact, those recently added to the city's force have without exception replaced farmer collectors who either have given up routes voluntarily or have been replaced on account of irregular or unsatisfactory service. This method of extending the area served directly by the city's force very naturally has led to little heed being taken of the more or less exact factors which should limit the size of individual routes. The size of the routes was originally determined by the farmers on the basis of the quantity of garbage they desired to collect daily. In consequence the routes are not well balanced and even now there are no accurate data in the hands of the city officers responsible for the work to show the relationship between quantity of garbage, number of collection stops, time required for collection, time required for hauling to disposal points and working speed of collectors.

The farmer collectors obviously must be permitted to define for themselves the size of their routes. So long as they collect garbage without cost to the city or householders it makes no difference what length of working day they observe or how much they collect each day. The sole interest of the city officers is that they shall assume responsibility for certain areas, collect regularly with the desired frequency from those areas and observe the ordinances relating to the transportation of garbage through the streets. It is of importance, however, that the work of the city's own collectors be properly regulated and controlled. These men, who are paid a monthly wage, must be required to observe a certain standard of performance or else the collection costs will become unduly high.

Checks on the operations of the city collectors indicate that these men, on the average, work about five and one-half hours per day. It requires about two or two and one-half hours to collect a load of garbage and about three hours to haul that load to the piggery, unload it and return to the city. The size of the load and the time of collection vary considerably and appear to bear little relation one to the other. This is made evident by Table No. 1. The irregularity of performance of the individual collectors is shown in this table also.

These figures indicate the need for establishing better standards of performance, for readjusting routes and methods so as to utilize the full working day, and for balancing the sizes of routes. The first two requirements can be met, it is believed, only after improved equipment has been installed. They will be discussed below in that connection.

* Concluded from page 179.

The third point, however, may be dwelt upon at more length here.

It is an established fact that the number of premises from which collections can be made in a given length of time does not vary materially from one season of the year to another. In summer and fall when the quantity of garbage produced per collection stop is relatively high, that quantity limits the number of stops per load. If the number of loads collected per day is established on that basis, it will be found that the same number of stops will be visited in the same length of time during the other seasons of the year. The essential thing in garbage collection is that each house shall receive the same number of collections with regularity each week, not that the loads collected shall maintain a certain weight. Therefore, the method of procedure in determining the size of routes is to discover the speed rate of the collectors, the number of premises each one can visit (with the equipment provided) in the time allowed for house to house pick up. This may be ascertained best during the season of maximum production, since the capacity of the equipment provided and the method of operating that equipment will exert its maximum influence then. With this rate determined, the frequency of collections will fix the size of routes, assuming that the routes represent the work of one week. This size will be constant, for the collector concerned, throughout the year, unless the frequency of collection is changed. When production becomes less, freezing weather and transportation difficulties will tend to maintain the balance.

It has been demonstrated in St. Paul that a good collector visits about 144 premises (residential) in two and one-half hours, collecting one load, during the heavy garbage season. This is at the rate of 1.04 minute per stop and closely corresponds to results obtained elsewhere under similar conditions. During this time there is collected about 1.5 tons of garbage, at the rate of 0.6 ton per hour. This weight rate of collection varies at present between routes and between districts, the latter being determined with reference to disposal points. (See Table No. 2.) Such variation, however, is not of especial significance since, as stated, regularity of time is of greater importance than equality of load weight in garbage collections. Variation in weight-rate of collection is bound to occur with changing seasons, and even from week to week; but variation in time-rate per stop is less excusable and should be reduced to a minimum.

TABLE NO. 1
Variation of Hauling and Collecting Time and Load Weight*

Route	Load Weight—Pounds Max.	Min.	Var.	Collecting Time—Hrs. Avge.	Max.	Min.	Var.	Hauling Time—Hrs. Avge.	Max.	Min.	Var.	Avge.	Load Time Max. Load	Avge. Work Day Hrs.
1	1850	1660	11.14	1767	4.17	3.67	13.50	3.92	1.50	1.33	12.8	1.42	3.75	6.76
2	2090	1550	13.00	1911	3.00	2.17	38.20	2.63	1.50	1.17	28.1	1.28	2.50	5.19
3	1675	825	103.00	1405	3.42	2.17	57.50	2.83	2.08	1.92	8.2	1.97	2.33	6.77
4	2175	1300	67.75	1547	2.67	2.33	14.50	2.27	1.33	1.17	13.8	1.23	2.17	4.73
5	1400	980	43.00	1166	2.58	1.83	40.90	2.15	2.00	1.58	26.5	1.78	1.73	5.71
6	1500	735	104.50	925	1.50	1.17	28.20	1.33	1.45	1.25	16.0	1.37	1.42	4.07
7	2125	1400	51.50	1859	3.58	2.50	43.10	3.07	1.50	0.75	100.0	1.01	2.92	5.09
8	2250	1315	71.00	1685	2.17	1.83	18.70	1.97	1.58	1.17	35.0	1.33	1.92	4.63
9	1600	1100	45.40	1350	2.17	1.92	13.00	2.03	1.67	1.42	17.5	1.48	2.17	4.99
10	1575	1100	43.00	1337	3.58	2.58	38.70	3.18	2.17	1.67	28.9	1.87	3.58	6.92
11	1675	1100	52.25	1358	2.42	1.50	61.20	1.93	1.42	1.25	13.6	1.32	2.42	4.57
12	1735	1125	54.20	1618	3.25	2.67	21.80	2.93	1.33	1.17	13.6	1.25	2.92	5.43
13	1400	600	133.50	995	3.08	1.58	94.80	2.53	1.42	1.10	29.0	1.25	3.08	5.03
14	1775	1065	66.70	1338	3.25	1.50	116.50	2.58	1.42	0.75	89.3	1.13	3.25	4.84
15	2225	1125	97.50	1615	3.00	2.25	33.40	2.68	1.75	1.50	16.7	1.30	2.50	5.28
16	1615	1400	15.25	1541	3.00	2.33	28.80	2.68	1.83	1.50	22.0	1.40	2.83	5.48
Avge.	1791	1148	60.79	1463	2.92	2.12	41.40	2.54	1.62	1.29	29.4	1.39	2.59	5.34

*Load weights for season of light garbage. Time factors remain fairly constant throughout the year.

TABLE NO. 2
Rate of Garbage Collection, City of Saint Paul

(a) District	(b) Daily Production Max. Tons	Min. Tons	Load Weight Max. Tons	Min. Tons	(c) Collection Rate per Hour Max.	Min.	Av'ge
I	7.89	3.32	1.58	0.83	0.45	0.24	0.35
II	10.63	4.45	1.18	0.49	0.47	0.19	0.33
III	26.46	10.45	1.46	0.62	0.62	0.27	0.45
Total	45.00	18.22					
Avge.			1.39	0.64	0.51	0.23	0.38

(a) District I hauls to Rauchnot farm; District II, to Green farm; District III, to Northern Stock Co.
(b) Figures are approximate averages for the routes concerned, taken from records of Bureau of Sanitation.
(c) Figures based on reports of Bureau of Sanitation and results of time studies made during August and September, 1921.

EQUIPMENT AND COST OF COLLECTION

It was stated in the foregoing that the average working day of city collectors now is about five and one-half hours. The conditions under which the work is done, furthermore, fix this length of time, which is not therefore attributable to the men themselves. As stated, the wagon boxes used hold about three cubic yards, which can readily be collected in two and one-half hours during the summer and early fall. The length of haul from loading point to disposal point averages 4.5 miles, which requires about three hours for making the round trip. Hence with the present equipment and methods, the length of the working day is fairly established.

It is obvious that the cost of collection is as high as it is largely because of the fact that the collectors are given eight hours' pay for five and one-half hours' work. (It was in recognition of this that the

collectors on November first accepted a reduction in pay from $185 to $160 per month.) Hence the problem to be solved in Saint Paul is one largely of adjusting methods and equipment so as to obtain eight hours' work each day from the collectors. There is no comparable saving possible from a reduction of pay for fewer working hours, unless the men are paid on an hourly basis. (In the present instance, the reduction of rate of pay by $25 per month does not even approximate the reduced production of the operating force. Reduction of rate of pay, for example, in direct ratio to actual working hours would make the new basis $138.75 per month instead of $160.)

The operation of garbage collection may be divided into two parts: First, the house-to-house pick-up work; second, the hauling to disposal points. (In some cities the latter may be further divided, but this condition does not obtain in Saint Paul.) Economy generally results from a complete separation of the two. One set of equipment and one part of the working force may be used in the pick-up work, and the other in the hauling. This is especially true where the length of haul is reasonably long. In Saint Paul, for example, two and one-half hours are required to collect a load, or to visit and collect from 144 premises, and three hours are required to haul and dump it and return to the starting point. The latter operation, therefore, prevents the collectors from picking up more than one load per day. If they were not required to haul, they could pick up three loads in eight hours. These three loads, in turn, could be hauled to the disposal plants in somewhat less than nine hours. Thus two units of force and equipment might do the work now performed by three.

The next point of inquiry may properly be as to the character of the collection equipment. The present equipment, as previously stated, consists of ordinary wooden boxes mounted on running gear, the box capacity being about three cubic yards. The boxes cannot be dumped (unloading requires about 20 minutes) and they are not water tight. To this extent they do not conform to the minimum requirements which may well be adopted as standard for such equipment, i. e., they should be water tight, steel dump bodies. A further requirement may well be added, that they should be equipped with suitable covers.

The capacity of the wagon boxes must in all cases be adjusted to obtain the best results from the operating force. It is important that the collectors be employed as steadily as possible throughout the working day. It is also necessary that the equipment be of such size that it may readily be maneuvered through the streets and alleys of the city. The one factor tends to increase the capacity, and the other to limit it. For Saint Paul, with the large number of unimproved streets and narrow alleys, it is believed that the second factor limits the effective capacity to about three yards or 3,600 pounds.

When consideration is given the second part of the collection operation, i. e., hauling, it again is evident that economy in hauling requires large loads. The length of haul in the present instance, 4.5 miles average, indicates also the economy of motor equipment for this part of the operation, and this in turn argues again for large loads. A heavy duty truck can haul three loads of the size suggested for the pick-up equipment. This points to the advantage of trailers that may be hauled by teams for the pick-up work and in trains of three or more by trucks or tractors to the disposal points.

The installation of trailer equipment is being considered in Saint Paul and will be made when funds are available for its purchase. The writer has suggested the purchase of 14 trailers of three-yard capacity and of the side-dump type, equipped with wide tires and brakes. These trailers would be operated on seven routes, which would cover the territory now served by the 32 city collectors. They would be operated each unit by two men, collecting from opposite sides of the streets or alleys. This doubling of the collectors with each unit of equipment has been demonstrated to increase the rate of collection per unit by about 80 per cent.

It is estimated that the cost of collection with this equipment and under this plan of operation will be reduced by about one-third, and that the unit cost per ton will approach $4.25 at existing wage rates.

Cement Prices Falling

Bids under $2 a barrel for Portland cement have been received recently by the state highway departments of some of the mid-western states, this being a considerable reduction below bids received by the same states in January. On February 2nd the state highway commission of Indiana asked for bids on 211,544 barrels of cement to be used in constructing 56 miles of the National road from Richmond to Terre Haute. Eight companies competed and five of them submitted identical bids. When Governor McCray learned of this he called the five companies into a conference and informed them that unless the price of cement was reduced concrete would not be laid on the road this year.

On February 28th bids were again received with the result that the prices were reduced more than 20% below the low bid of the previous letting. The Louisville Cement Company was the lowest, offering the cement in sacks at $1.96 a barrel. The Atlas Portland Cement Company offered $1.90 f.o.b. plant, but the Louisville company had the advantage of about 18 cents a barrel in freight rates, the Louisville rate being 42 cents a barrel which will bring the actual cost to the state to $2.36 a barrel, subject, however, to a rebate of 40 cents for return of sacks. The highest bid at the plant in this letting was $2.07.

Bids for cement were also received on the same date in Springfield, Ill., and Madison, Wis., and those in Illinois showed reductions from previous biddings, but in Wisconsin only one bid was reduced from the previous letting. In Illinois offers were made on 4,000,000 barrels of cement at from $1.30 to $1.40 a barrel; the $1.30 being a reduction of 25 cents a barrel from the bid made by the same company on January 8th.

Soon after the first of the year, the highway commissions of five middle western states joined in an agreement to demand lower cement prices, this following the high bids received by Illinois in January, which were rejected. The result of the cooperation is evident from the reductions obtained within two months, as shown by the figures above.

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Conservative Engineering

The award of the contract for building the river section of the New York-New Jersey vehicular tunnel has disposed of a number of important engineering points that have elicited strongly contradictory opinions, without positively settling any of the questions involved except in so far as to make arbitrary requirements for this work.

The design was necessarily difficult on account of the wholly problematical initial volume and rapidity of growth of the traffic, the uncertain features of construction, and the very unsettled condition of labor and material market prevailing when and since the designs were made and since the first estimates were made, which may well account for a very large percentage of variation in the cost, thus involving either an excessively high price to insure the contractor against loss, or heavy gambling on his part on the future state of the market. Estimates have already been materially reduced by delay, and it is possible that a sliding scale of unit prices based on current fluctuations would have still farther reduced the cost while it obviously would have put a large amount of the uncertainty on the owners, where it belongs, and insured a just basis of profit and loss for both contractor and owner.

Very diverse technical opinions prevailed as to the proper diameter of the tunnel, as to the amount of traffic it would receive, as to the desirability of one or two tubes, as to the number of traffic lanes to be provided in each tube, as to the amount and cost of ventilation, as to the materials and methods of construction, and as to location and terminals.

Great difficulties were predicted for the construction of a very large tube and considerable economy for the construction of successive multiple small tubes. A compromise was effected by reducing the maximum proposed construction, but retaining a diameter larger than that of any similar tunnel in this country.

In the principal essentials of design and construction this work will conform to established precedents and there is no room for doubt that it will be executed in accordance with the contract and the official estimate, thus securing high class construction for an agreed price, and removing as much as possible the element of uncertainty from this important public work.

On the other hand an opportunity for developing the methods of tunnel construction and a possibility of important economies with little apparent danger or adverse results for the public has been neglected and no very striking advance in the art is likely to attend the work.

In any event it is an important and interesting construction, in competent hands, which will be carefully watched by engineers and contractors and cannot fail to be of great benefit to the public.

A Large Unnecessary Municipal Bill

Full responsibility should be fixed and adequate penalties imposed for any carelessness or incompetence that can be shown to have caused the wholly unnecessary injury to the submerged water main, delivering the Catskill Aqueduct supply across the Narrows of New York Harbor to the Borough or Richmond, which resulted in a serious menace to Staten Island and requird very expensive emergency work that it is estimated will cost the city $60,000.

The occurrence appears, on the face of it, to be an utterly careless and inexcusable one for which the stockholders of a corporate business would be very likely to demand a rigid investigation. Being, however, only a comparatively small item in the budget of hundreds of millions of dollars expended annually by this city, it is possible that it may not even lead to precautions calculated to prevent a repetition of such carelessness.

This large and expensive water main, vital to the interests and safety of one of the city boroughs, was carefully designed and constructed under competent supervision, and successfully installed and tested in a very difficult and inaccessible position, the location of which was accurately determined and recorded and was under city supervision. A short time ago the pipe sustained a sudden injury, so serious as to throw it wholly out of commission and dangerously cripple the service it had maintained, and which apparently could not have been caused by any inherent weakness in itself, but was apparently due to the

operation of a large dredging machine, which was then in service in the immediate vicinity or possibly in the exact position of the break, and was using heavy anchorage spuds powerfully driven deep in the bottom and entirely capable of penetrating the twenty feet of fill which was the only protection with which the pipe had been provided. No other solution of the accident has been offered, and it is difficult to see how a break of the character described could otherwise have occurred. As both the dredge and the pipe were under full control of the city it may be argued, as in the case of the slave who stole and ate the master's pig, that "no offence was committed since both were the property of the same owner."

Although the possibility of an accident to the pipe had been foreseen and the importance and difficulty of its immediate repair acknowledged by the design of a special sleeve adapted for rapid and advantageous repairs of such a fracture, and although the construction of such a sleeve would take several weeks, not one was held in stock for emergency, and special methods for making the repair had to be designed and applied on the spur of the moment at an estimated cost of $60,000.

Sewage Disposal With Digestion Tank

Editor of Public Works.

Dear Sir:

I have been very much interested in the discussion of Imhoff tanks appearing from time to time in PUBLIC WORKS: and other engineering journals.

It may not be wholly amiss or wholly uninteresting to your readers to state our experience, not with Imhoff tanks, but with an entirely different type.

Our city is small with a normal population between 2,500 and 3,000, and probably about 750 are connected with the city sewers.

Our town is a popular summer resort, so that we have very varying conditions from time to time. Our sewage flow in winter is about 75,000 gallons daily and during the summer from two to three times this amount largely increased at the week-ends.

Our type of tank is a single-story three-compartment tank. Compartments arranged side by side, two settling tanks outside and the digestion tank between.

Settling tanks are 16 ft. by 18 ft. by 16 ft. deep with hopper bottoms with sides sloping at the bottom 1 to 1.

The central compartment is 6 ft. by 18 ft. and 16 ft. deep with hopper bottom.

Two 12-inch inlet pipes take the raw sewage from the by-pass direct to the bottom of each settling tank, if both are in operation, following W. G. Kirchoffer's design. Twelve-inch pipes controlled by gate valves admit the settled sludge from the bottom of the settling tanks to the digestion tank. A scum board extends across the rear of each settling tank about 2 feet from the effluent weir.

There are two scum gates between each settling tank and the digestion tank and a 10-inch sludge discharge pipe extends from the bottom of sludge tank to a point 5 ft. below the top of the sewage in the tanks.

The entire tank is housed in with proper ventilation.

The writer has entire charge of the plant and gives it his personal attention. Once every week the plant is visited and thoroughly gone over as follows:

The digested sludge is drawn, after the drying bed has been cleaned and renewed. The scum is all moved through the scum gates into the middle compartment and thoroughly broken up either with water through a hose nozzle or by hand, which removes the entrained gasses and causes a large part of it to settle. The settled sewage is drawn from each settling tank into the middle tank, the bottom of each tank is flushed through pipes placed around the top of the hopper bottom in each tank.

The sludge is not drawn in winter, neither is water used for breaking up the scum. The above operation is repeated each week and the tank has needed no further attention.

We get an excellent quality of sludge and an effluent that needs no further treatment but is discharged directly into a creek.

The effluent is nearly clear and odorless and shows only a mere trace of sediment after being kept in a bottle for a week.

No life has been found in the effluent, that is, no life that comes from the tank.

We allow no oil wastes and no grease to be discharged into the system, all garages and sinks being carefully trapped.

The writer believes there is more in the care and attention given the operation of any good system than there is in a difference of design. I believe also that frequent drawing of the sludge will prevent a great deal of trouble. We have had no foaming or boiling and the scum never exceeds a few inches in thickness.

We have never removed any scum, but all has been settled and digested. Our dried sludge amounts to about 25 or 28 yards during the season.

Respectfully,

J. G. Skeels,
City Engineer, Lake Geneva, Wis.

Handling Sludge from Imhoff Tanks

About ten years ago Willmer, Minn., installed an Imhoff tank. Since that time many additions have been made to the sewer system but none to the tank, and it is now being operated beyond its estimated capacity. In an effort to save the expense of installing additional tanks during the high prices of the last few years, the city has been pumping sludge from the tank every two weeks throughout the year and apparently with fair success.

There are 580 connections to the system and in addition a few catch basins, which latter should, of course, not be connected with the system, which is supposed to be for sanitary sewers only. There is about 12 miles of pipe.

Since the construction of the plant, with the exception of one year, it has been under the charge of J. A. Rowat as engineer, and at our request he has furnished the information on which this description is based. At present he is using a 4-inch diaphragm pump to pump the sludge from the tank to the sludge bed. As pumped, the sludge contains 80 per cent. to 90 per cent. of water. The sludge bed is made of broken stone about 18 inches deep, underlaid with tile on a good grade. The water drains out of the sludge in about a week, so that it can be hauled in wheelbarrows out of the building which has been erected over the sludge bed.

The sludge is wheeled a short distance where it is removed by farmers living near the city and also by property owners in the city. Mr. Rowat states that he has used it on the lawn at his home for the last four or five years. It is generally spread over the farm or other land by pitch forks, as would be ordinary manure. While the sludge is free, no inducements are offered to dispose of it but it is simply left to be taken by any who desire.

The first few years there were some complaints of odors from the tank, but examination showed that most of them came from another source near the plant and since that time there have been no complaints. The sludge which is used for fertilizer occasionally has a slight odor, but generally it is well decomposed before coming out of the tanks and is not especially offensive.

Recent Legal Decisions

CONDITIONAL FINDING OF COMMISSIONERS HELD NOT SUFFICIENT TO AUTHORIZE ROAD IMPROVEMENT

In mandamus proceedings to compel county commissioners to proceed with a road improvement, the Kansas Supreme Court holds, Herman vs. Larkin, 202 Pac. 980, that under the statute requiring that as a preliminary to the construction of proposed road improvements the county board must find them to be of public utility, where an entry is made upon the commissioners' journal, reciting that it was found that the improvements asked are of public utility, and are ordered made on condition that the road connects with others outside of the country, and that federal aid should be received, this language should be construed as attaching the conditions to the finding as well as to the order, and such a conditional finding is not sufficient to authorize an order for the construction of the proposed improvement. The court said: "To give a basis for hard-surfacing a highway the county commissioners must make an absolute and unequivocal finding that it is of public utility. Naturally in such a case as the present, they will not like to do this, unless it is to be a part of a general system and the usual federal aid is to be had." Although the findings and orders were not effective, however, the commissioners still had authority to proceed; and it was, indeed, suggested by the court to be their duty to take some definite action in the matter.

WATER COMPANY'S RATES HELD EXCESSIVE

In the ascertainment of a reasonable and fair return upon capital used by a corporation engaged exclusively in the business of supplying water to a city and its inhabitants, whose stock and bonds represent money actually employed in the business, the West Virginia Supreme Court of Appeals holds, City of Huntington vs. Public Service Commission, 110 S. E. 102, that the amount of interest annually paid on its indebtedness and the dividends it pays or can pay upon its stock are material and forceful elements to be considered, and it is not entitled arbitrarily to rates which will produce sufficient net income to provide, after payment of all taxes, for 2 per cent. for depreciation and 7 per cent. as a return to it, calculated upon the estimated value of all its property, it appearing that more than two-thirds of the money used in its business is borrowed at the rates of 5 and 6 per cent.

BURDEN ON COUNTY TO SHOW THAT ITS APPROVAL OF WORK WAS OBTAINED BY FRAUD

In a suit by a board of supervisors and a drainage district to set aside the final report of the engineer in charge of the construction of a drainage ditch and the supervisors' approval of the report, and to recover for alleged defects in the work, the Iowa Supreme Court holds, Board of Supervisors vs. Sargent Tile Ditcher Co., 186 N. W. 14, that the burden was on the board to show that the approvals of the engineer and the board were secured by fraud, and that the evidence was insufficient to show the fraud alleged.

STATE BOARD OF HEALTH MAY STOP FURNISHING IMPURE WATER TO COMMUNITY, BUT CANNOT DIRECT PARTICULAR MODE OF DOING SO

The Kentucky Court of Appeals holds, Purnell v. Maysville Water Co., 234 S. W. 967, that, although the State Board of Health has the power to abute a nuisance, source of filth, or cause of sickness, it has no mandatory power enabling it to direct the method by which the result shall be accomplished. It can only cause the abatement of the nuisance, and is not concerned with the method by which it is done. It may stop the furnishing of impure and dangerous water to a community, but it cannot direct a water company to install any particular character of plant for sedimentation, filtration, or chlorination of the water, and the water company may adopt any system that may seem best or expedient to it, if the system adopted produces the results desired—clear, soft, wholesome water. It is therefore held that the board cannot require a water company to install a filtration plant after it has installed a chlorination plant which the undisputed evidence shows has rendered the water wholesome.

COMPETITIVE BIDDING FOR SIDEWALL CONSTRUCTION NOT NECESSARY IN KENTUCKY TOWNS OF SIXTH CLASS

It is not necessary to let contracts for the construction of sidewalks by competitive bidding in towns of the sixth class in Kentucky. Privet v. Shirley, Kentucky Court of Appeals, 234 S. W. 740.

REQUIREMENTS OF NOTICE TO BIDDERS FOR ROAD BONDS

In an action by a county for breach of contract for the purchase of certain road bonds, the Oklahoma Supreme Court holds, McMahan vs. Copiah County, Miss., 202 Pac. 1007, that a notice to bidders for such bonds is not defective because it fails to state the amount of the bonds, the date of their maturity, where they are payable, or the rates of interest they are to bear, where the notice as published refers to the order authorizing the issuance of the bonds. A bid is presumed to have been submitted with full knowledge of everything contained in the order referred to.

LAND OWNED BY CITY OUTSIDE LIMITS NOT TAXABLE UNDER COLORADO CONSTITUTION

In an action against the city and county of Denver for taxes on real property owned by it in connection with its waterworks system outside the city limits, the Colorado Supreme Court holds, Stewart vs. Denver, 202 Pac. 1085, that land owned by a city outside of its limits is exempt from taxation under Const. Art. 10, §4, although it is not necesssary for any municipal purpose, the constitutional provision making no exception, and therefore the defendant's property outside the city limits was all exempt from taxation, although part of it might be unnecessary for waterworks or other municipal purposes.

NEWS OF THE SOCIETIES

CALENDAR

Mar. 20—CONNECTICUT STATE SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Spring meeting. Taft Hotel, New Haven.

Mar. 21—PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Hydro-electric symposium.

Mar. 22-23—INDIANA SANITARY AND WATER SUPPLY ASSOCIATION. 15th annual convention. Claypool Hotel, Indianapolis.

Mar. 22-23-24—IOWA ROAD OFFICIALS. Tenth annual conference State Highway Commission's office, Ames, Ia.

Mar. 24—CHICAGO ENGINEERS' CLUB. Annual meeting. Secretary—H. H. Cosley, 110 S. Dearborn St., Chicago.

Mar. 24-25—TEXAS SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS. Spring meeting. Fort Worth, Tex.

Mar. 29-30—ILLINOIS SECTION, AMERICAN WATER WORKS ASSOCIATION. Fourteenth annual meeting. Urbana, Ill.

Apr. 3-5—NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES. Drake Hotel, Chicago.

Apr. 5-6—AMERICAN SOCIETY OF CIVIL ENGINEERS. Spring society meeting. Dayton, Ohio.

Apr. 19—NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies Bldg., New York City.

Apr. 19-21—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. General meeting. Chicago, Ill.

Apr. 19-21—TRI-STATE WATER AND LIGHT ASSOCIATION OF THE CAROLINAS AND GEORGIA. Spartanburg, S. C.

Apr. 25-28—BUILDING OFFICIALS' CONFERENCE. Annual meeting. Hotel Lincoln, Indianapolis, Ind.

Apr. 26-28—SOCIETY OF INDUSTRIAL ENGINEERS. National spring convention. Detroit, Mich.

Apr. 27-29—BUILDING OFFICIALS' CONFERENCE. April 27-28, Cleveland, O.; April 29, Massillon, O.; April 30, Youngstown, O.

May 8-12—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Atlanta, Georgia.

May 15-19—AMERICAN WATER-WORKS ASSOCIATION. 42d annual convention. Bellevue-Stratford Hotel, Philadelphia. Secretary, J. M. Diven, 153 W. 71st St., New York.

May 16-18—CHAMBER OF COMMERCE OF U. S. A. 10th annual meeting. Washington, D. C.

June 4-6—AMERICAN ASSOCIATION OF ENGINEERS. 8th annual convention. Salt Lake City, Utah.

June 13-16—CANADIAN GOOD ROADS ASSOCIATION. Annual convention. Victoria, B. C.

June 19-22—AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Summer meeting. Clifton Hotel, Niagara Falls.

June 26-July 1—AMERICAN SOCIETY FOR TESTING MATERIALS. 25th annual meeting. Chalfonte-Hadden Hall Hotel, Atlantic City, N. J.

Sept. 25-28—SOUTHWEST WATER WORKS ASSOCIATION. Annual convention. Hot Springs, Ark.

Oct. 9-13—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Cleveland, Ohio.

NATIONAL CONSTRUCTION CONFERENCE

An important conference will be held under the auspices of the National Federation of Construction Industries at the Drake Hotel, Chicago, April 3, 4, 5, 1922, co-operating with the Federation are the U. S. Department of Commerce, Bureau of Standards, U. S. Department of Labor, Bureau of Labor Statistics, U. S. Bureau of Mines, U. S. Gelogical Survey and the Domestic Distribution and Fabricated Production Departments of the Chamber of Commerce of the United States of America, and all national, regional and local associations of architects, engineers, insurance interests, financial and building loan companies, constructors, builders, sub-contractors, builders' exchanges, material and equipment producers, wholesalers and retailers, executives and workers.

The conference will be held in conjunction with the fourth American Lumber Congress and meetings of other construction organizations.

Preliminary Announcement—Feature 1—A demonstration by displays of associations or individual firms showing "Progress made throughout the industry" in design, research, simplification and standardization of products, or any other developments tending toward a better distribution and utilization of materials, lower productions costs, a more continuous operation of producers' plants, mills and quarries, lower construction costs, successful apprenticeship systems, economies through proper safety measures, and any other developments which have tended to eliminate the wastes of the combined industry. Over 25 associations and individual firms have already advised they will prepare interesting displays.

Feature 2—On the evening of April 5 a great construction industry dinner will be held.

Other special features will be announced.

AMERICAN SOCIETY OF CIVIL ENGINEERS

At the regular business meeting March 1, G. F. Stickney presented the subject of "Siphon Spillways" which was the title of his paper appearing in February "Proceedings." Discussion was led by Edward Wegmann and W. P. Creager, members, Am. Soc. C. E., illustrated by appropriate slides and formed an important contribution to the field of hydraulic engineering.

COLORADO SOCIETY OF ENGINEERS

The Colorado Society of Engineers has elected the following officers for the ensuing year: President, R. M. Hosea; Vice-president, W. M. McMechem; and Secretary-Treasurer, C. M. Lightburn.

MICHIGAN ENGINEERING SOCIETY

The annual meeting of the Michigan Engineering Society, the state assembly of the American Association of Engineers, was held February 8-10 at Kalamazoo. The topics discussed at this meeting included ethics, co-operation in the building field, the highway situation, municipal problems, from zoning and planning to administration by the city-manager form of government and the working out of the registration law.

NORTH DAKOTA CHAPTER, A. A. E.

The following officers were elected by the North Dakota chapter of the American Association of Engineers at its recent convention at Bismarck: President, William Barnes; First Vice-president, J. N. Roberty; Second Vice-president, E. H. Morris; Third Vice-president, George H. McMahon; Fourth Vice-president, J. E. Kaulfuss; Fifth Vice-president, H. C. Frahm, and Sixth Vice-president, R. T. Jacobson.

WASHINGTON SOCIETY OF ENGINEERS

The meeting of the Washington Society of Engineers, held on March 1 at the Cosmos Club, Washington, was addressed by S. S. Arentz, member of Congress from Nevada, on "The Engineer in Politics."

SOCIETY OF INDUSTRIAL ENGINEERS

A meeting of the Society of Industrial Engineers was held on March 14 at the Auditorium Hotel, Chicago. The subject, "Effects of Modern Sales and Advertising Methods Upon Stabilization," was discussed by a general manager of an industry, a sales manager, and an economist or a labor leader.

JOINT ENGINEERING MEETING

The joint meeting of the Metropolitan section with the A. I. E. E., A. S. C. E. and A. I. M. E. at the Engineering Societies Building, N. Y., is to be devoted to "The Port of New York."

PERSONALS

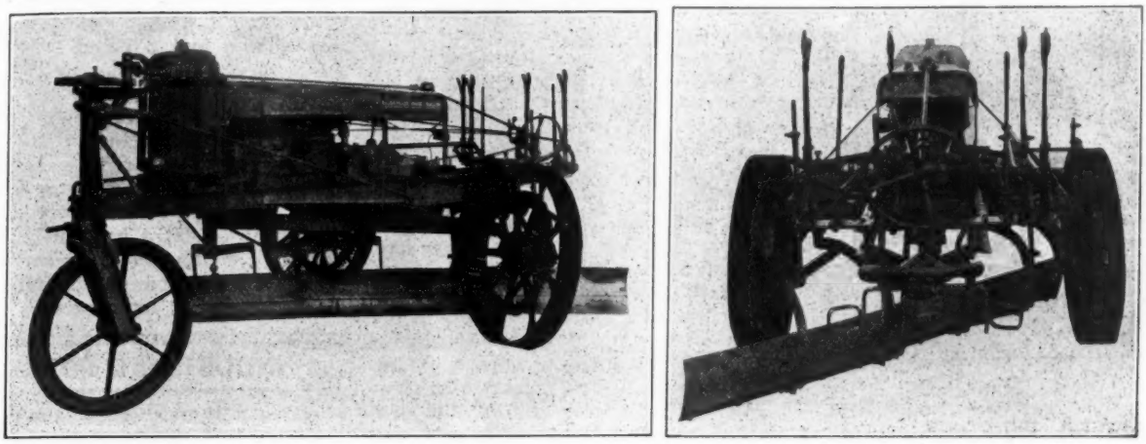
Biles, Geo. H., formerly assistant highway commissioner of Pennsylvania, has been appointed to highway commissioner to succeed Louis F. Sadler, recently deceased. Mr. Biles has been in the Pennsylvania State Highway Department since 1905 and in 1913 became maintenance engineer and organized the present maintenance division in charge of all of the street's completed highways. Mr. Biles has announced his policy of connecting, during the coming season, as many of the already constructed constructions of primary highways as the department's researches will permit.

Johnson, George E., state engineer of Nebraska, secretary of the board of public works and chairman of the Capitol Commission, has tendered his resignation, effective January, 1923.

Brown, R. C., has been appointed acting state highway engineer of South Carolina, to South Carolina, to succeed Charles H. Moorefield, resigned.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



REDUCED SIZE AVERY COMPANY'S ONE-MAN ROAD RAZZER, SHOWING BLADE IN UP AND IN DOWN POSITIONS.

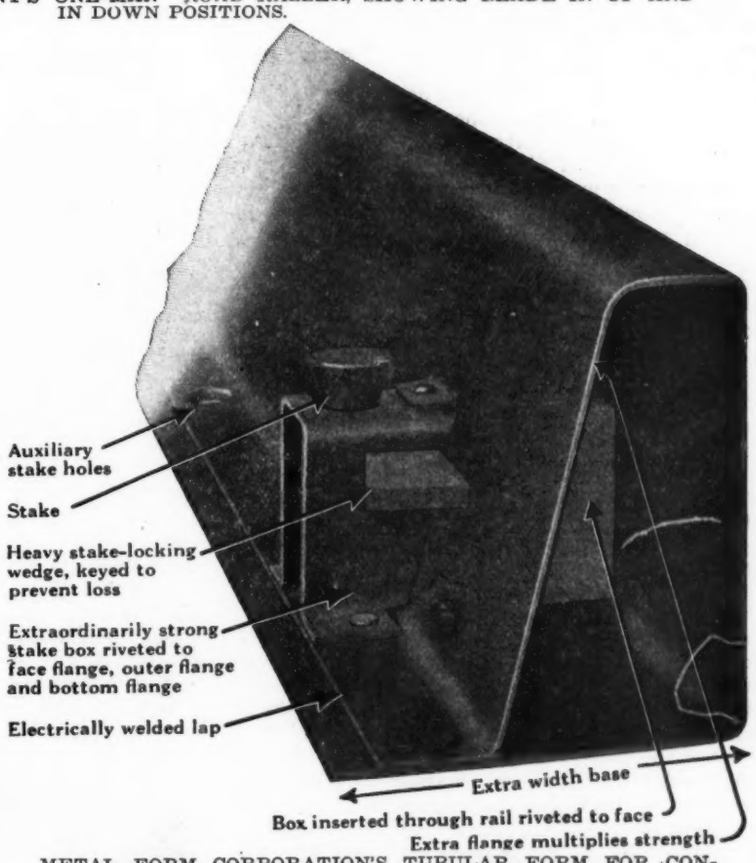
NEW SIZE ROAD-RAZER

In order to provide a machine for making a smooth surface on narrow rough roads, the Avery Company has just put on the market a new reduced size one-man road-razer with a three-section blade, 10 feet 3 inches long, that cuts an area 7 feet wide and is intended to operate successfully on narrow roads and streets without interfering with traffic. The design is like that of the original Road-Razer, except for the reduced dimensions and it is of simple, sturdy construction, calculated for durability, efficient service, and small maintenance cost. It is operated by the driver seated in the rear over the cutting blade, is provided with spring adjustments, and is easily steered through a mitre gear, swinging the castor-like single front wheel.

METAFORM ROAD RAILS

The Metaform Road Rails, manufactured by the Metal Form Corp., Milwaukee, are stiff tubular forms for concrete roads, pavements and foundations. They are designed and built to afford the most durable, permanent equipment and to withstand misuse, having unusual initial strength afforded by tubular construction, box bracing, and extensive riveting, and electric welding.

The joints are so constructed that two or more rails can instantly be lifted out. The extra wide bottom flange width, 5¾ inches, gives a large area of bearing surface on soft ground; the stake boxes are riveted to the rails in three places, and the stakes themselves are secured by locking wedges. Additional stake holes are provided between the boxes. The rail is entirely enclosed so that concrete cannot penetrate the interior. It is made in heights of 6, 7, and 8 inches and in standard lengths of 10 feet. The stakes have special conical heads, facilitating their removal.

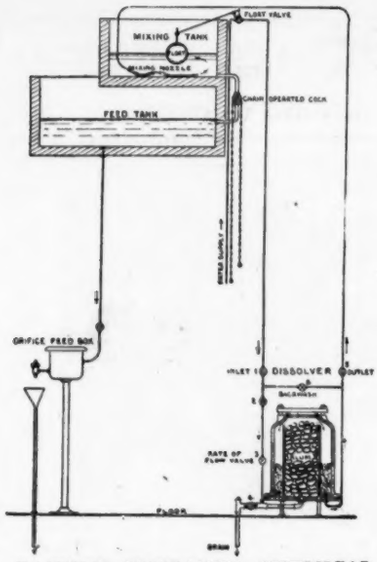

Auxiliary stake holes
Stake
Heavy stake-locking wedge, keyed to prevent loss
Extraordinarily strong stake box riveted to face flange, outer flange and bottom flange
Electrically welded lap
Extra width base
Box inserted through rail riveted to face
Extra flange multiplies strength

METAL FORM CORPORATION'S TUBULAR FORM FOR CONCRETE ROADS, PAVEMENTS AND FOUNDATIONS

CHEMICAL DISSOLVER

This apparatus, sold by the Bannon Company, Ltd., can be used for dissolving various chemicals and is specially recommended for the preparation of alum solutions for water filtration plants where it will eliminate the multiple wooden tanks, stairs, elevated platform, motor, belts, shafting and other apparatus and the inconvenience and labor of handling alum and agitating it by the ordinary process.

Standard dissolvers, with capacities of 1 2 an' 4 cubic feet of substance



BANNON COMPANY'S CHEMICAL DISSOLVER. USED FOR WATER-WORKS FILTERING AND OTHER PURPOSES.

to be dissolved are coated inside with acid-resisting enamel. The dissolver is a pressure resisting, double chambered container, fitted with inlet and outlet pipe connections, operating cocks and rate of flow valve.

A known weight of filter alum being placed in the inner compartment, the inlet and outlet valves are opened permitting a definite number of gallons of water to flow through the dissolver under pressure in a length of time that will insure every particle of alum being dissolved. About 100 minutes is usually allowed to wash every trace of alum from the dissolver.

The filtered solution of varying strength is piped, under pressure, to the mixing tank, where the flow into the tank is through a nozzle, the stream being directed against the floor of the tank. This nozzle creates a violent churning action in the tank which effectively mixes the contents of the tank.

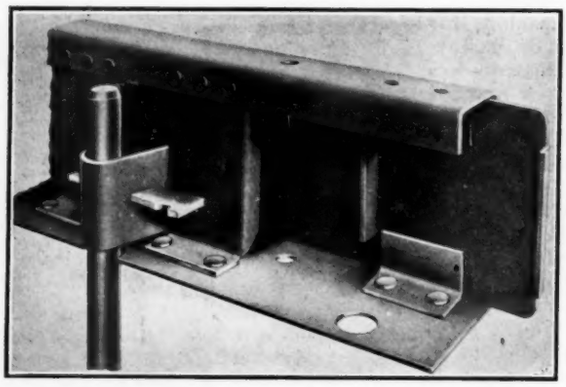
The solution is emptied, by means of a valve, into the feed tank, from which it flows to the orifice box and thence to the coagulation tank.

The dissolver may be located near the alum storage, the mixing tank in any out of the way place (up near the ceiling) and the orifice box wherever convenient for inspection and operation. Whenever the operator happens to notice by the gauge glass that the solution in the feed tank is getting low, he pulls the operating chain and empties the freshly mixed solution from the mixing tank into the feed tank.

The solution is filtered and the orifice cannot become plugged, as is frequently the case with other methods. A float operated valve in the mixing tank shuts off the water supply to the dissolver when the required number of gallons is in the tank. The sand in the dissolver can be backwashed by proper manipulation of the valves.

BLAW-KNOX FORMS FOR ROADS AND STREETS

The steel road forms manufactured by the Blaw-Knox Co. are used for the construction of any kind of concrete road, bituminous surface roads or brick roads, foundations for all classes of roads, curbs, integral curbs, and gutter construction. They have many exclusive features, including: the independence of the separate 10-foot sections which can be removed at any point and at any time without disturbing the adjacent sections; a positive staking system which locks the form securely in the ground and holds it permanently in place to line; the method of hanging the form to the removable stake by means of a heavy wedge or key that insures perfect alignment even in the softest ground; the provision of five special stiffening plates that support the top and bottom flanges; the heavier stakes and wedges and stake straps; and the strongly riveted slip joint connections. All of these features go to give increased durability, strength and efficiency to the forms. The improved C road forms are made of the highest grade No. 9 blue annealed open hearth steel plates of standard length of 5 and 10 feet and heights of 5 to 9 inches with a weight of 9 pounds per foot for the 6-inch size. They can be built up to any required height and the slip joint connections and other parts are securely riveted, making them integral with the form and eliminating loose parts.



BLAW-KNOX IMPROVED C ROAD FORM.

The circular shows details of many different standards and combinations and has half tones of forms installed on several important jobs, one of which, in Arizona, used 25,000 linear feet of them.

RAPID TRENCH DIGGING IN BAD GROUND

A Pawling and Hanischfeger trencher model 152, owned by Charles L. Smith & Sons, Dayton, Ohio, has recently made an excellent record by excavating in 6 hours running time 225 linear feet of trench through very difficult soil containing boulders 2 feet in diameter that were imbedded in flinty flat rock strata, which under the action of the machine broke into sections about 2 feet square and 6 inches thick that were very conspicuous in the spoil banks deposited along the side of the trench, making it resemble an old-fashioned New England stone fence.

These machines are of very sturdy construction, enabling them to successfully withstand the heavy stresses and abuse of extra hard digging and insuring continuous efficient work without delay and expense for frequent repairs, or replacement.

INDUSTRIAL NOTES

Joseph S. Webster & Co., a sales force organized by Joseph S. Webster, of New Haven, Conn., is to represent the Kingsford Foundry & Machine Works, Oswego, N. Y., in the New England states on Kingsford-Webster water-tube boiler sales. Offices will be established in Providence and New Haven.

W. A. Alexander has been appointed district engineer in charge of the Helena, Mont., office of the Portland Cement Association.

C. L. Dewey, who was associated with Carl Akeley in the invention and development of the cement-gun and who has done much work along this line, has joined the forces of the Cement-Gun Construction Co., of Chicago, Ill.

George S. Hedge and Frederic W. Mattheis, dealers in construction equipment, will shortly open offices in Boston, Mass.

The Cummings Machine Co., Inc., Minster, Ohio, announces a change of name to the Industrial Equipment Co., Ind. There will be no other changes as a result of this.

W. F. Jolley has been appointed manager of the London office of the Holt Manufacturing Co., Peoria, Ill., and will have charge of sales of the company's line of tractors in Europe and Africa.

The Worthington Engineering Co., 317 McNnight Bldg., Minneapolis, registered engineers, have reorganized and are specializing in municipal engineering.